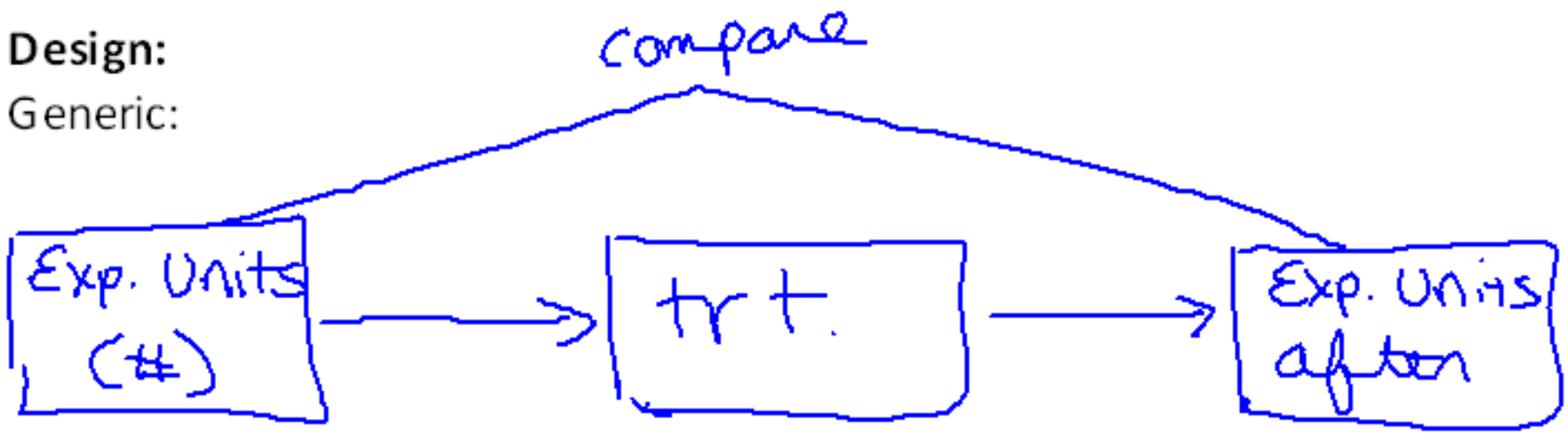
Section 3.2: Experimental Design

(1) Comparative Experiment

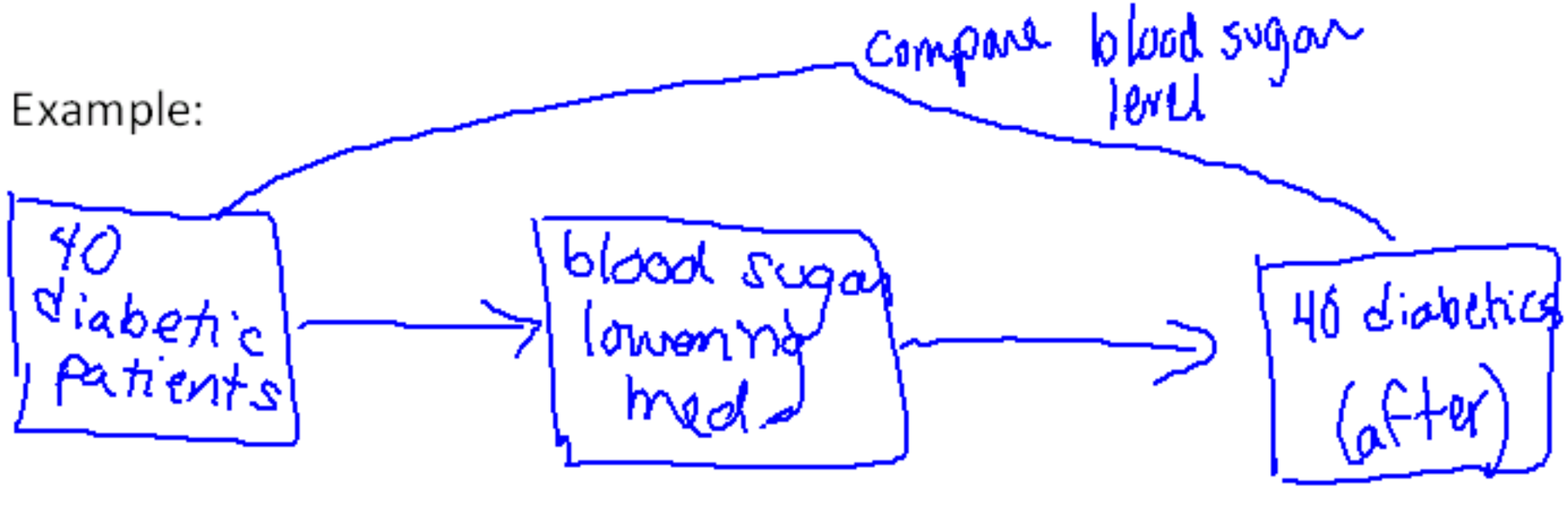
- A single treatment is applied to all the experimental units
- Measure before and after and compare

Design:

Generic:



Example:



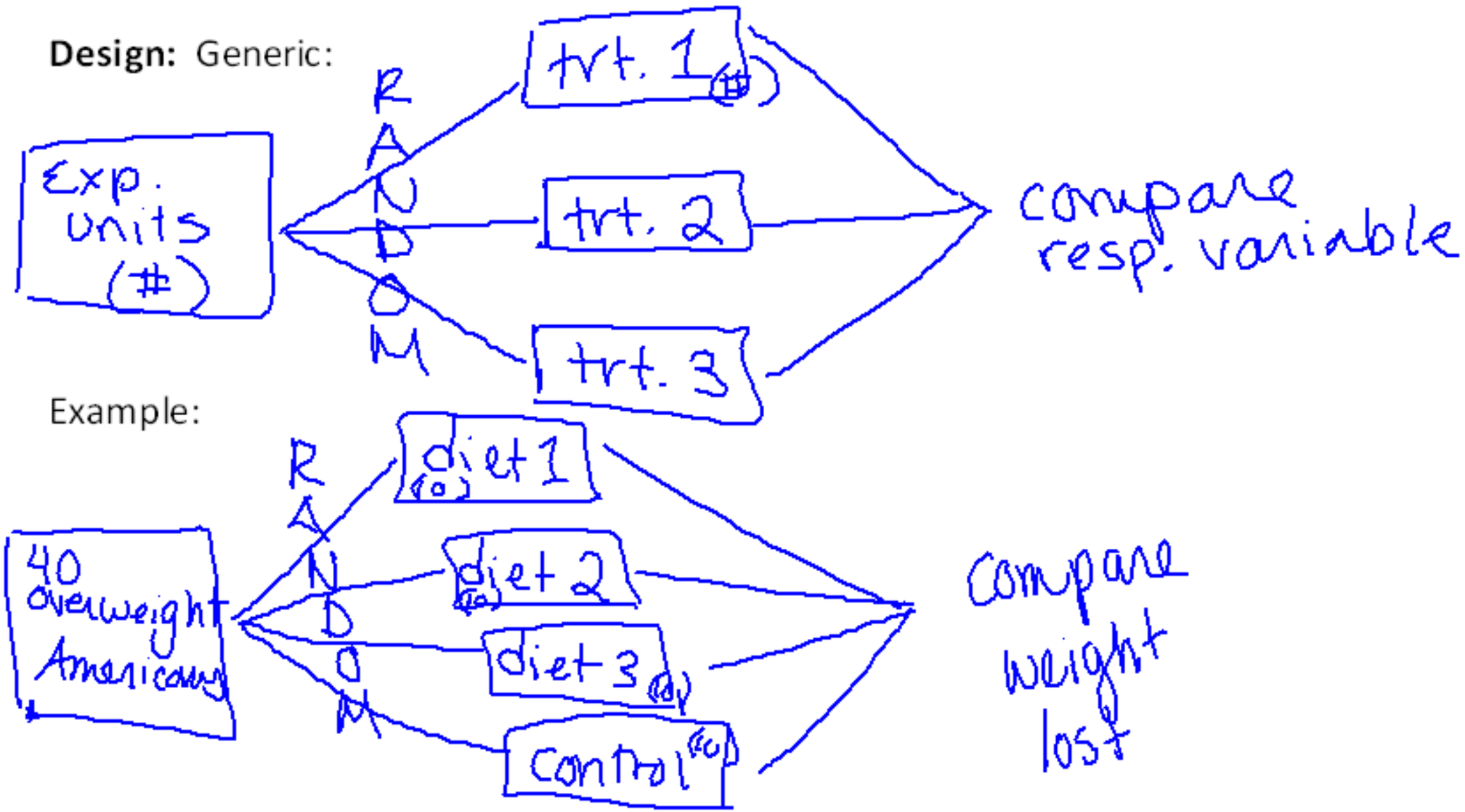
Concerns:

- Placebo effect- no way to tell if this is happening
- Bias- no way to tell! There is no comparison/control group
- No control
- No randomization

(2) Randomized Comparative Experiment (a.k.a. Completely Randomized Design)

- Uses randomization to divide experimental units into different treatment groups
- Compares the results of different treatment groups to each other
- **Try to use control whenever possible**

Design: Generic:



Example:

Other:

- Single blind:
  - When the experimental units do not know which one of them is getting which treatment

- ***Double blind:***
  - When both the experimental units and the researchers that are interacting with the experimental units (handing out meds, recording results) don't know who is getting which treatment

Example 1: I want to test out a new plant food. So I take 20 plants, and give half the new plant food and half no food at all. All of the plants get the same amount of water and sunlight each day. After 30 days, I measure the height that the plant has grown, and also how many flowers it has on it.

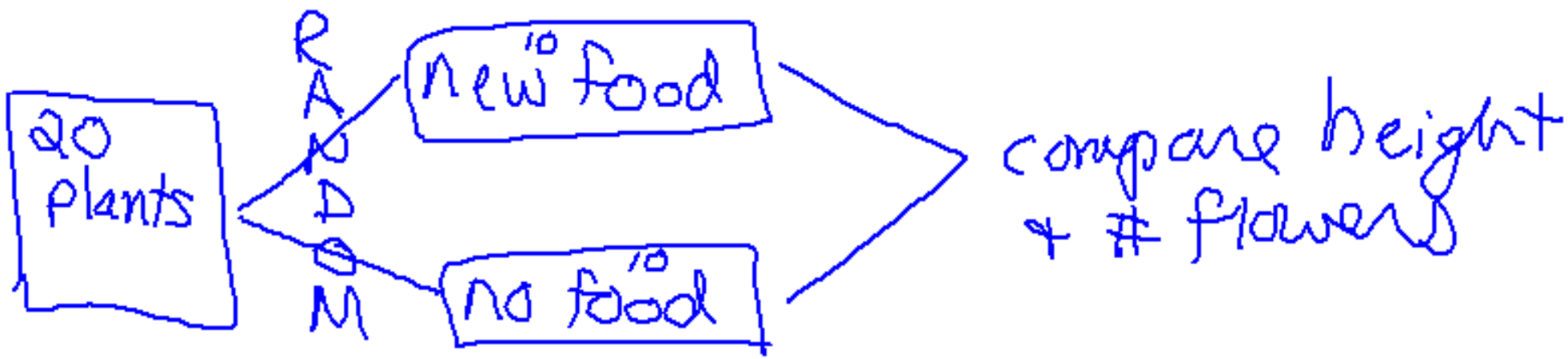
Individuals: plants

Treatment(s): new food, no food

Response Variable(s): height, flowers

Experiment or Obs. Study:

Design the experiment:



Example 2:

High cholesterol level in people can be reduced by exercise or by drug treatment. A pharmaceutical company developed a new cholesterol-reducing drug. Researchers would like to compare the effects of the new drug with the currently used and accepted drug. 100 Volunteers who have a history of high cholesterol and who are currently not on any medication will be recruited to participate.

What are the treatments? What are the subjects/individuals?

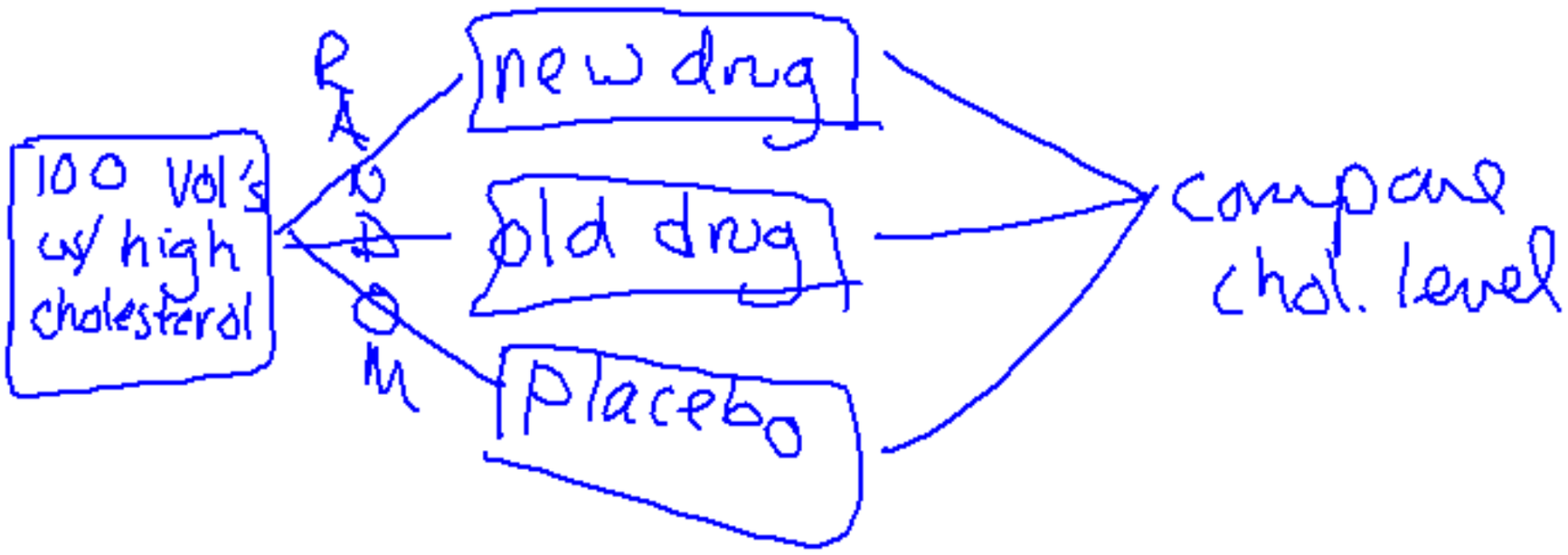
new & current drugs — 100 volunteers w/ high chol.

What is the response variable?

cholesterol level

Would a placebo group be appropriate/necessary? Why or why not?

a) Design the experiment below:



(3) Block Design (Blocking)

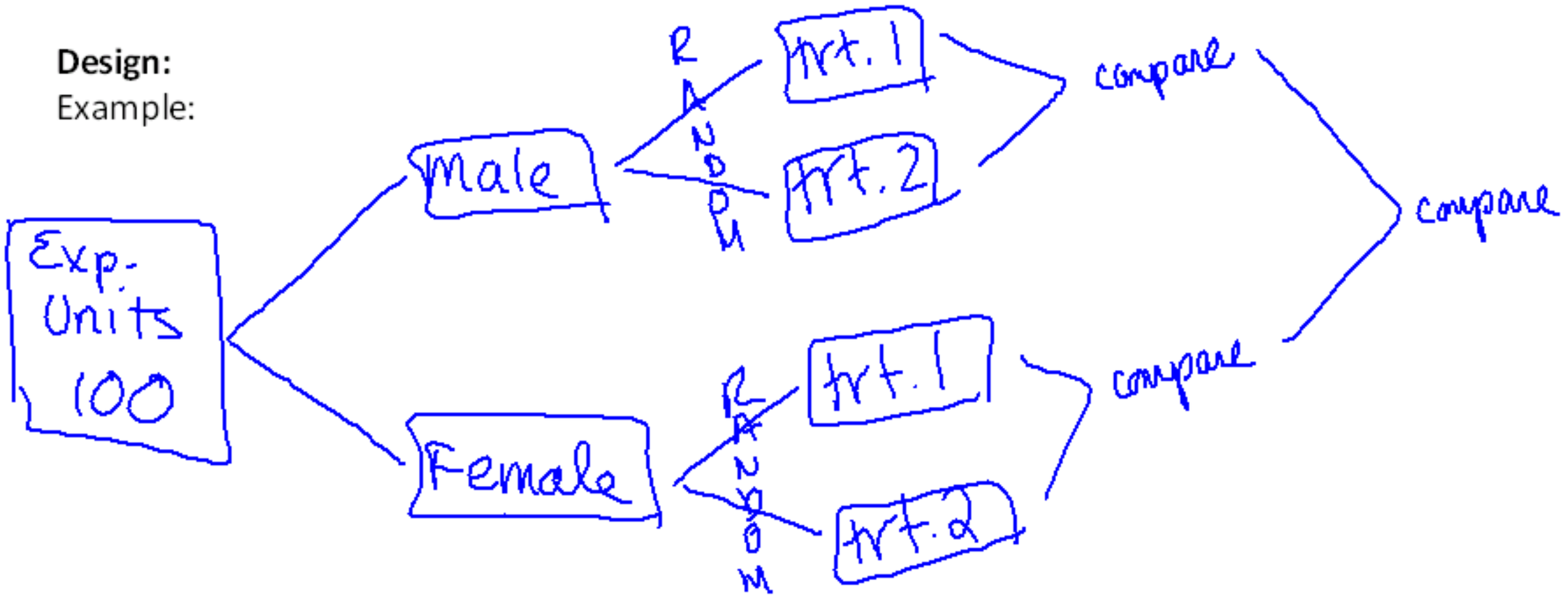
- Special addition to the Completely Randomized Design

- **BLOCKS = group of experimental units that are alike in some way** lurking vars.

- ~~Slit~~ Split the exp units into blocks, then randomize within the blocks to the treatments

Design:

Example:



Example 3:
Let's go back to the experiment on people with high cholesterol. We wanted to test the effect of new and old drug. We also thought a control group would be useful. There are 100 volunteers with high cholesterol that are currently not on meds that are available.

Individuals:
Treatment(s):
Response Variable:
Experiment or Obs. Study:

What are some lurking variables in this experiment?

Using this variable, create a block design experiment

Example 4: Men and women respond differently to advertising. An experiment to compare the effectiveness of 3 TV commercials for the same product will want to look separately at the reactions of the different genders, and assess their overall responses to the ads. There are 70 people available for the experiment.

What are some lurking variables in this experiment?

Using this variable, create a block design experiment

(4) Matched Pairs Design
(specific type of block design)

- Only 2 treatments
- Each experimental unit gets both treatments
- Randomization comes by which treatment comes 1st or 2nd.

Design:
Generic:

Example:

Concerns:

- Control? Bias?

When thinking about doing matched pairs... ask the following questions:

(A) What are the 2 treatments?

(B) Can both treatments be applied to each individual?

(C) How could each individual have BOTH treatments applied to them?

Example 5:
We want to test the effectiveness of two types of tires (call them A and B) on cars. We gather 50 cars for our experiment. We will be measuring the amount of wear on the two types of tires. The cars will be driven normally for 3 months. How could we BEST design this experiment?

(A) What are the individuals? What is the response variable?

(B) What are the treatments?

(C) Design the experiment:

(D) Can this experiment be double blind?

Example 6:

Go back to the car tires experiment. Suppose the cars were all different (SUVs, sports cars, sedans, trucks, etc.). How would you reduce this lurking variable of car size/type?